Unit 09

TRANSPORT

Q.1. Why transport is necessary? How it takes place in living organisms?

Ans. Why transport is necessary:

In order to run the metabolic processes occurring in the body of living organisms, cells need some materials from environment and also cells need to dispose some material into the environment. For this purpose, materials are transported to and from cells.

Transport in living organisms:

In unicellular and simple multicellular organisms, diffusion can work only because every corner of their body is in close and direct contact with environment. In complex multicellular bodies, cells are far apart from the environment and such bodies need a comprehensive system for transport of materials.

Q.2. Describe briefly transport in plants?

Ans. Role of water:

Water plays a vital role in life of plants, because it is necessary for.

(i) Photosynthesis

(ii) Turgor

(iii)Regulation of temperature within cell.

Absorption of water:

Land plants get water and minerals from soil through roots, and transport it to the aerial parts of plants. During photosynthesis, food is prepared and transported from leaves to other parts of plants for utilization and storage.

Transport of water and Food:

Vascular tissues (xylem and Phloem) are present in all plants, (except for mosses and liverworts), that move water and food throughout the plant body.

Q.3. Describe how water and ion uptake occurs in plants?

Ans. Introduction:

In addition to anchoring the plant, roots perform two other vital functions.

(i) Absorbs water and salts from the soil.

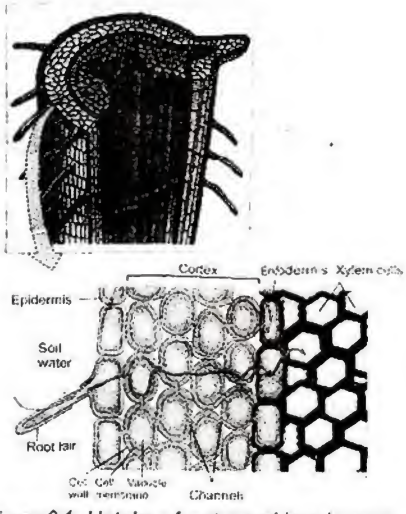


Figure 9.1: Uptake of water and ions by root

(ii) Secondly, they provide conducting tissues for distributing these substances to the tissues of the stem.

2. Internal Structure of Root

(i) Conducting Tissues

Conducting tissues (xylem and phloem) of root are grouped in the centre to form a rod shaped core, which extends throughout the length of the root.

(ii) Pericycle

Outside the conducting tissues, there is a narrow layer of thin walled cells, the pericycle.

(iii)Endodermis and Cortex

A single layer of cells, endodermis surrounds the pericycle layer. External to this, there is a broad zone of cortex which consists of large and thin walled cells.

(iv) Epidermis

The cortex is bounded on the outside by a single layer of epidermal cells.

(v) Root Hairs

Roots also have cluster of tiny root hairs, which are actually the extensions of epidermal cells.

Functions of Root Hair:

(i) Large Surface Area for Absorption

Root hairs provide large surface area for absorption. They grow out into the spaces between soil particles where they are in direct contact with the water.

(ii) Absorption and Transport of Water

The cytoplasm of the root hairs has higher concentration of salts than the soil water, so water moves by osmosis into the root hairs. Salts also enter root hairs by diffusion or active transport. After their entry into the root hairs, water and salts travel through intercellular spaces or through cells (via channels, called plasmodesmata) and reach xylem tissues. Once in xylem, water and salts are carried to all the aerial parts of plant.

Q.4. What is transpiration. Describe transpiration and factors affecting rate of transpiration.

Ans. Transpiration:

1. Definition:

"The loss of water from plant surface through evaporation is called transpiration".

2. Occurrence of transpiration:

This loss may occur through stomata in leaves, through the cuticle present on leaf

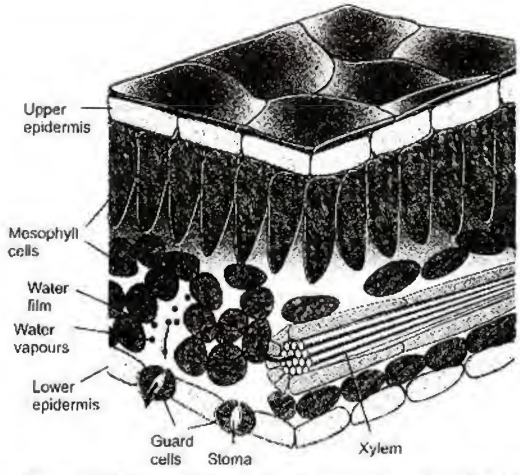


Figure 9.2: Events of transpiration shown in the section of a leaf

epidermis, or through special openings called lenticels present in the stems of some plants.

3. Stomatal transpiration:

Most of the transpiration occurs through stomata and is called stomatal transpiration. The mesophyll cells of leaf provide large surface area for the evaporation of water. Water is drawn from the xylem into mesophyll cells, from where it comes out and makes a water-film on the cell walls of the mesophyll. From here, water evaporates into the air spaces of the leaf. By diffusion, water vapours then move from air spaces towards the stomata and then pass to outside air. Roughly 90% of the water that enters a plant is lost via transpiration.

4. Opening and closing of stomata:

(i) Process of opening and closing of stomata

Most plants keep their stomata open during the day and close them at night. The two guard cells of a stoma are attached to each other at their ends. The inner concave sides of guard cells that encloses a stoma are thicker than the outer convex sides. When these guard cells get water and become turgid, their shapes are like two beans and the stoma between them opens . When the guard cells loose water and become flaccid, their inner sides touch each other and the stoma closes.

(ii) Mechanism of stomatal opening and closing

(a) Concentration of solute (Glucose) in the guard cell is responsible for opening and closing of stomata. Recent studies have revealed that light causes the movement of (K^+) Potassium ions from epidermal cells into guard cells.

(b) Water follows these ions and enter guard cells. Thus their turgidity increases and stoma opens.

(c) As the day progresses, guard cells make glucose i.e., become hypertonic. So water stays in them. At the end of the day, the K^+ flow back from guard cells to the epidermal cells and the concentration of glucose also falls. This initiates the loss of water and reduces turgor pressure in guard cells, which causes the closure of stomata.

Factors affecting rate of transpiration **(Lahore board 2011 G I,II)**

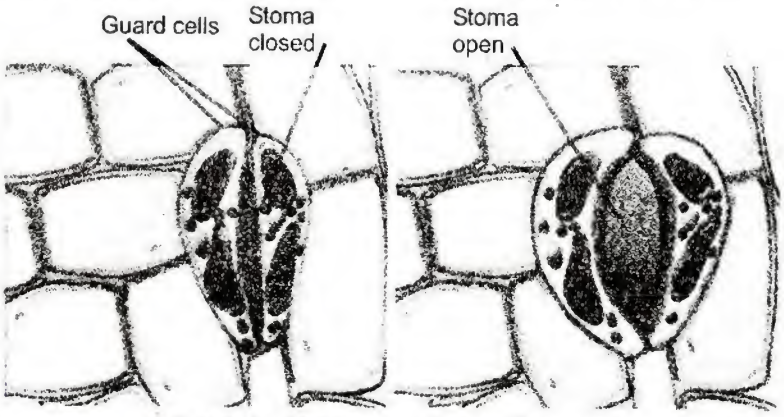


Figure 9.3: Opening and closing of stoma

Following factors affect the rate of transpiration.

1. Light

The rate of transpiration is directly controlled by opening and closing of stomata and it is under the influence of light. In strong light, the rate of transpiration is very high as compared to dim light or no light.

2. Temperature

Higher temperature reduces the humidity of the surrounding air and also increases the kinetic energy of water molecules. In this way, it increases the rate of transpiration. The rate of transpiration doubles with every rise of 10° C in temperature. But very high temperature i.e., 40-45° C causes closure of stomata, so that transpiration stops.

3. Air Humidity **(Lahore board 2012 G II)**

When air is dry, water vapours diffuse more quickly from the surface of mesophyll cells into leaf air spaces and then from air spaces to outside. This increases the rate of transpiration. In humid air, the rate of the diffusion of water vapours is reduced and the rate of transpiration is low.

4. Air movement

Wind (air in motion) carries away the evaporated water from leaves and it causes an increase in the rate of evaporation from the surfaces of mesophyll. When air is still, the rate of transpiration is reduced.

5. Leaf Surface area

The rate of transpiration also depends upon the surface area of leaf. More surface area provides more stomata and there is more transpiration.

Q.5. Describe the significance of transpiration?

(Lahore board 2011 GII)

Ans. Introduction

Transpiration is called a necessary evil. It means that transpiration is a potentially harmful process but is unavoidable too.

1. How transpiration is harmful?

Transpiration may be a harmful process in the sense that during the conditions of drought, loss of water from the plant results in serious desiccation, wilting and often death of the plant.

How is transpiration necessary?

(Lahore board 2012 G I)

(i) Transpirational Pull

It creates a pulling force called transpirational pull which is principally responsible for the

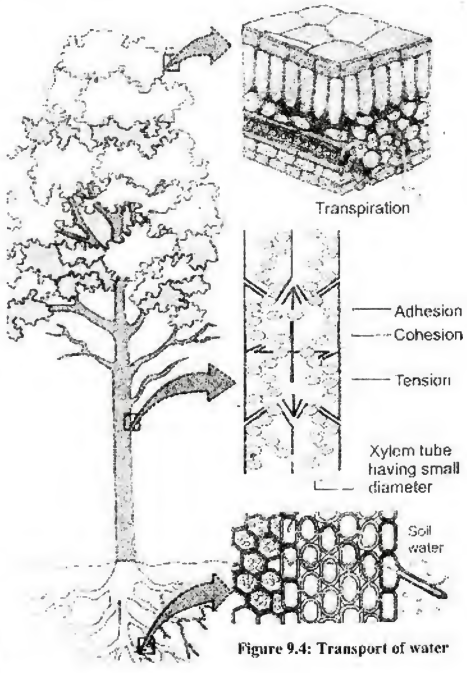


Figure 9.4: Transport of water

conduction of water and salts from roots to the aerial parts of the plant body.

(ii) Cooling effect

When water transpires from the surfaces of the plant, it leaves a cooling effect on plant. This is especially important in warmer environments.

(iii)Gaseous exchange

Wet surfaces of leaf cells allow gaseous exchange.

Q.6. How transport of water in plants takes place?

Ans. Introduction:

The process by which water is raised to considerable heights in plants can be explained by cohesion tension theory.

Cohesion-tension theory

According to this theory, the force which carries water (and dissolved materials) upward through the xylem is transpirational pull. Transpiration creates a pressure difference that pulls water and salts up from the roots.

Explanation

When a leaf transpires (loses water), the water concentration of its mesophyll cells drops. This drop causes water to move by osmosis from the xylem cells of leaf into the mesophyll cells. When one water molecule moves up in the xylem of the leaf, it creates a pulling force that continues all the way to the root. This pulling force created by the transpiration of water is called transpirational pull. It also causes water to move transversely (from root epidermis to cortex and pericycle).

Reasons for the creation of the transpiration pull

(i) Water is held in a tube (xylem) that has small diameter.

(ii) Water molecules adhere to the walls of xylem tube (adhesion).

(iii) Water molecules cohere to each other (cohesion).

These attractions allow an overall tension among water molecules and form 'columns' of water. The columns of water move from root to shoot and the water content of the soil enters in these columns.

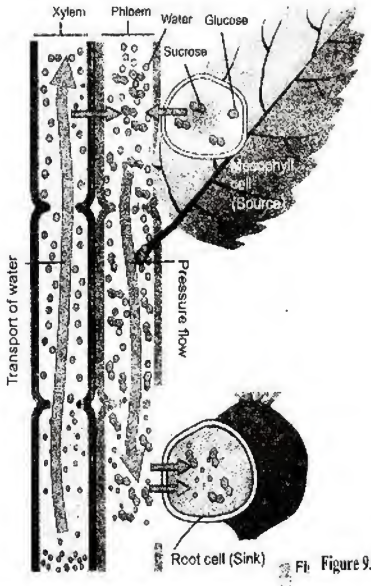


Figure 9.5: Transport of food

Q.7. How transport of food in plants takes place?

Ans. Transport of Food

Phloem is responsible for transporting food substance throughout the plant. Phloem is a two way street for food. In most plants, the food is transported in the form of sucrose.

Importance of Food

The glucose formed during photosynthesis in mesophyll cells is used in respiration and excess of it is converted into sucrose.

Pressure-Flow mechanism

In pressure-flow mechanism, the food is moved from sources to sinks.

Sources:

The sources include the exporting organs typically a mature leaf or storage organ. A storage organ is capable of storing food and exporting the stored materials.

Sinks:

Sinks are the areas of active metabolism or storage e.g., roots, tubers, developing fruits and leaves, and the growing regions. Similarly, root of beet is a sink in first growing season, but becomes source in the next growing season, when sugars are utilized in the growth of new shoots.

Explanation of Pressure-Flow mechanism

At the source, the food (sugar) is moved by active transport into the sieve tubes of phloem.

Due to the presence of sugar in sieve tubes, their solute concentration increases and water enters from xylem via osmosis. This results in higher pressure in these tubes, which drives the solution towards sink.

At the sink end, the food is unloaded by active transport. Water also exits from the sieve tubes. This decreases the pressure in sieve tubes, which causes a mass flow from the higher pressure at the source to the now lowered pressure at the sink.

Q.8. Explain the mechanism of transportation in human.

Ans. Transport in Human:

Transportation in human body consists of two complex systems.

(i) Blood circulatory system (cardio vascular system)

(ii) Lymphatic system

Closed Circulatory System

Human body have closed circulatory system (mean blood never leaves the network of arteries, veins and capillaries)

Main components of human blood circulatory system:

(i) Blood (Medium)

(ii) The heart (Pumping organ)

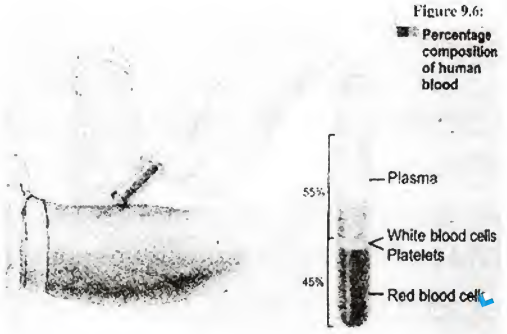
(iii) Blood vessels

Q.9. Write a note on composition of blood?

Ans. Blood:

Introduction

It is a specialized bodily fluid made up of connective tissue. It is composed of a liquid called blood plasma and blood cells.



Weight

Weight of blood in our body is about $1/12^{th}$ of our body.

Average Blood Volume in Adult

Average adult body has about 5 litres of blood.

Composition of Blood

In healthy person, plasma constitutes about 55% and cell or cell like bodies about 45% by volume of the blood.

Chemical Composition of Blood Plasma **(Lahore board 2012 G II)**

Water constitutes about 90-92% of Plasma and 8-10% are dissolved substances. Following materials present in the water of Plasma.

(i) Salts:

Salts make up 0.90% of the plasma by weight, Sodium chloride and Salts of bicarbonate are present in considerable amount. Ca, Mg. Cu, K and Zn are found in trace amounts. Changes in concentration of any salt can change the pH of blood. (Normal is 7.4)

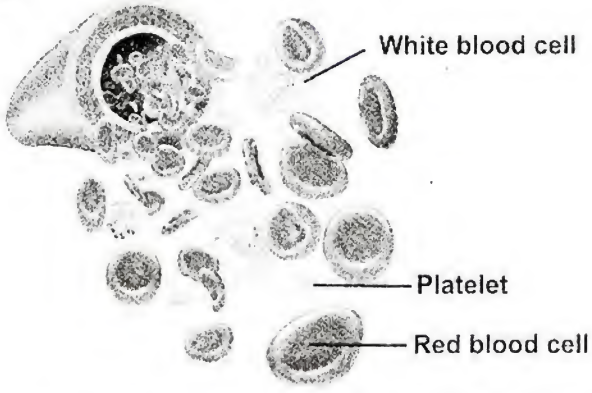


Figure 9.7: Different cells and Cell-like bodies in blood plasma

(ii) Proteins

Proteins make 7-9% by weight of plasma. The important proteins present in plasma are antibodies, fibrinogen (blood clotting protein), albumin (maintains the water balance of blood) etc.

(iii) Digested Food, Nitrogenous Wastes and Hormones

Plasma also contains the digested food (absorbed from digestive system), nitrogenous wastes and hormones.

(iv) Respiratory Gases

Respiratory gases i.e., CO_2 and O_2 are also present in plasma.

TYPES OF BLOOD CELLS IN PLASMA

1. Erythrocytes or red blood cells. (RBCs)

Number:

A cubic millimeter of blood contains 5 to 5.5 million red blood cells in males and 4 to 4.5 million in females.

Loss of Nucleus and other organelles

In the RBC's of mammals, the nucleus is lost when they get mature.

Composition of Cytoplasm of RBCs

95% of the cytoplasm of RBCs is filled with haemoglobin which transports O_2 and CO_2. The remaining 5% consists of enzymes, salts and other Proteins.

Shape

RBCs are biconcave and have an elastic cell membrane.

Formation

In the embryonic and foetal life, they are formed in liver and spleen.

In adults, they are formed in the red bone marrow of short and flat bones, such as the sternum, ribs and vertebrae.

Average Life Span

The average life span of a red blood cell is about four months (120 days) after which it breaks down in liver and spleen by phagocytosis.

Production and Death

In a normal person, about 2-10 million red blood cells are formed and destroyed every second.

2. White Blood Cells or Leukocytes (WBCs)

Introduction

These are colourless.

Location

They are not confined to blood vessels only as they also migrate out into the tissue fluid.

Number

One cubic millimeter of blood contains 7000 to 8000 WBCs.

Life Span

Their life span ranges from months to even years, depending on body's need.

Function

WBCs function as the main agents in body's defence system.

Types of leukocytes:

Leukocytes are divided into two main types.

(i) Granulocytes

(ii) Agranulocytes

(i) Granulocytes

Granulocytes are the leukocytes with granular cytoplasm. These include neutrophils, eosinophils and basophils.

(i) Neutrophils:

They destroy small particles by phagocytosis.

(ii) Eosinophils:

They break inflammatory substances and kill parasites.

(iii)Basophils:

They prevent blood clotting.

(ii) Agranulocytes

Agranulocytes are the leukocytes with clear cytoplasm. These include monocytes and lymphocytes (B & T lymphocytes).

(i) Monocytes

They produce macrophages which engulf germs.

(ii) Lymphocytes

They produce antibodies and kill germs.

3. Platelets (Thrombocytes)

Introduction

They are not cells, but are fragments of large cells of bone marrow called megakaryocytes. They do not have any nucleus and any pigment.

Number

One cubic millimeter of blood contains 250,000 platelets.

Life Span

The average life span of a blood platelet is about 7 to 8 days.

Function:

They play an important role in blood clotting. The clot serves as a temporary seal at the damaged area.

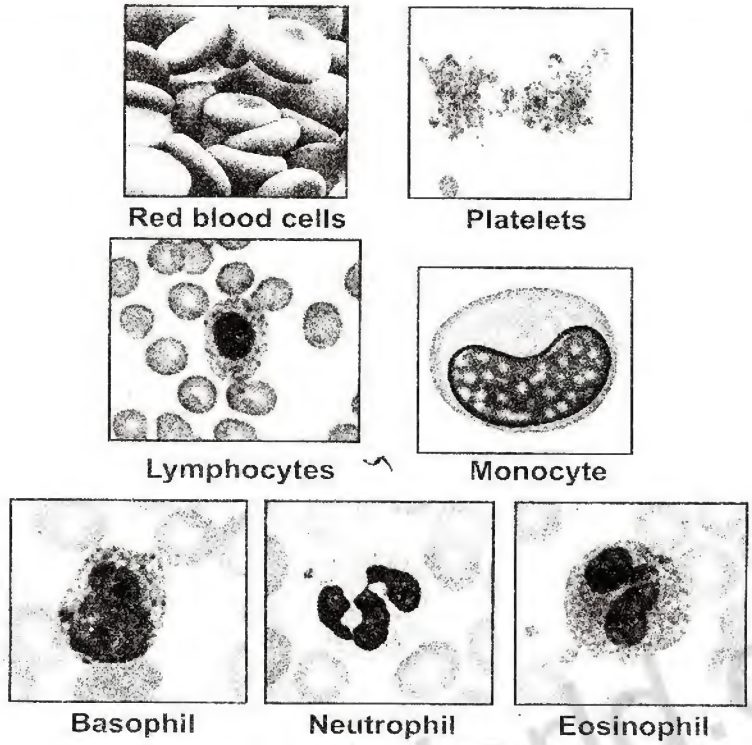


Figure 9.8: Composition of Blood

Table 9.1: Composition of Blood

	Description	**Amount in %age**	**Functions**
Plasma	Liquid portion of blood	55% by volume	Carries blood cells and important blood proteins, hormones, salts etc.
Cell Types	**Description**	**Average Number Present**	**Functions**
Red Blood Cells (Erythrocytes)	Like a biconcave disc; without nucleus; Contain haemoglobin	5,000,000 per mm^3	Transport Oxygen and a small amount of CO_2
White Blood Cells (Leukocytes)	Granular and agranular; contain nucleus larger in size than RBCs	7500 per mm^3	Play role in body's defense by different ways like: Engulf small particles, Release

			anticoagulants, Produce antibodies
Platelets (Thrombocytes)	Fragements of bone marrow cells (megakaryoctes)	250,000 per mm^3	Involved in blood clotting

Q.10. Explain different disorders of blood.

Ans. Blood Disorder:

There are many types of blood disorders including.

(i) Bleeding disorders. (Haemophilia)

(ii) Leukaemia (blood cancer)

(iii) Thalassaemia (Cooley's Anaemia)

i. Leukaemia (Blood Cancer)

Leukaemia is the production of great number of immature and abnormal white blood cells.

Cause of leukaemia:

It is caused by a cancerous mutation in bone marrow or lymph tissue cells and result in uncontrolled production of WBCs.

Treatment:

(i) During this serious disorder, patients need to change the blood regularly with the normal blood, got from donar.

(ii) The second method is bone marrow transplant, which is in most cases effective, but very expensive treatment.

ii. Thalassaemia (Cooley's anaemia)

It is also called Cooley's anaemia on the name of Thomas B. Cooley, an American Physician. It is a genetic problem due to mutation in the gene of haemoglobin. Patient cannot transport oxygen properly.

Cause of Thalassaemia:

The mutation results in the production of defective haemoglobin.

Treatment:

(i) Blood of patients is to be replaced regularly with normal blood.

(ii) It can be cured by bone marrow transplantation but it does not give 100% cure rate.

Q.11. Describe in detail blood group systems.

Ans. Blood group systems:

Blood group systems are a classification of blood, based on presence or absence of antigens on the surface of RBCs.

Antigen:

An antigen is a molecule that can stimulate an immune response (antibody production etc).

ABO Blood Group System:

(i) Discovery

It was discovered by the Austrian scientist Karl Land Steiner, in 1900.

(ii) Four Different Blood Groups

In this system, there are four different blood groups which are distinct from each other on the basis of specific antigens (Antigen A and B) present on the surface of RBCs.

Blood group A:

A person having antigen A has blood group A.

Blood Group B:

A person with antigen B has blood group B.

Blood Group AB

A person having both antigens has blood group AB.

Blood Group O:

A person having none of the A and B antigens has blood group O.

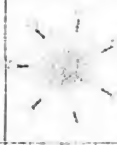
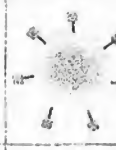
	Blood group A	Blood group B	Blood group AB	Blood group O
Red blood cell				
Antigen present	antigen A	antigen B	Antigen A & B	None
Antibody present	Anti-B	Anti-A	None	Anti-A & Anti-B

Figure 9.9: Presence and absence of antigens and antibodies in ABO blood group system

Types of Antibodies

After birth, two types of antibodies i.e. anti-A and anti-B antibodies appear in the blood of individuals.

(i) In persons with blood group A, antigen A is present and antigen B is absent. So their blood will contain Anti B anti bodies.

(ii) In person with blood group B, antigen B is present and antigen A is absent. So their blood will contain anti A antibodies.

(iii) In persons with blood group AB, antigen A & B are present i.e. neither is absent. So their blood serum will contain no antibody.

(iv) In persons with blood group O, neither antigen A nor antigen B is present i.e. both are absent so their blood serum will contain both anti A and anti B antibodies.

Q.12. Describe blood transfusion in ABO blood group system.

Ans. Definition:

A process of transferring blood or blood based product from one person into the circulatory system of another is called blood transfusion.

Need of Blood Transfusion:

It is a life saving process in some situation, such as massive blood loss due to injury. It can be used to replace blood lost during surgery, anaemia, sickle cell anaemia, thalassaemia, or Haemophilia may require frequent blood transfusions.

Cross Matching of Blood Groups:

Transfusion of blood is done after confirming that no agglutination results in the blood of recipient. Agglutination leads to the clumping of cells and clumped cells can not pass through capillaries. For the confirmation of no agglutination, blood samples of donor and recipient are crossed-matched for compatibility. Antibodies of the recipient's blood may destroy the corresponding antigen containing RBCs of the donor or the antibodies of the donor's blood may destroy the antigen-containing RBCs of the recipient.

Universal donor:

O blood group individuals are called universal donors, because they can donate blood to the recipients of every other blood group.

Universal Recipients

AB blood group individuals are called universal recipients, because they can receive transfusions from the donors of every other blood group.

Recipient Blood Groups

Donor Blood Groups	A	B	AB	O
A	✓	×	✓	×
B	×	✓	✓	×
AB	×	×	✓	×
O	✓	✓	✓	✓

Blood Transfusion: Cross matching

- ✓ : can be transfused
- × : agglutination

Q. 13. What do you mean by Rh Blood group system? Explain Blood transfusion in Rh Blood group system?

Ans. Discovery of Rh-blood Group System:

In 1930's, Karl Land Steiner discovered the Rh-blood group system.

Rh System:

In this system, there are two blood groups, i.e., Rh^+ positive and Rh^- negative.

Rh Factor:

These blood groups are distinct on the basis of antigens called Rh factor (first discovered in Rhesus Monkey) present on the surface of RBCs.

Rh Positive and Rh Negative:

A person having Rh factors has blood group Rh positive while a person not having Rh factors has blood group Rh negative.

Blood transfusion in Rh Blood Group System:

Rh-positive blood group can be transfused to Rh-positive recipient because recipient's blood already has Rh-antigens and it will not produce anti-Rh antibody. Rh-negative blood

group can be transfused to Rh-negative because donor's blood does not have Rh-antigen and so recipient's blood will not produce anti-Rh antibody. If an Rh-negative person receives Rh positive blood,

(i) He/she will produce anti Rh antibodies against Rh factors.

(ii) Rh negative blood can be transfused to Rh positive recipient, only if donor's blood (Rh negative) has never been exposed to Rh antigens and does not contain any anti Rh antibody.

Q.14. Describe the structure and function of human heart?

Ans. Introduction

The heart is a muscular organ responsible for pumping blood through the blood vessels by repeated contractions.

Meaning of Cardiac

The term cardiac means "related to the heart". Walls of heart chambers are made of cardiac muscles.

Location

In the human body, the heart is situated between the lungs, in the middle of the chest cavity (thorax) under the breast bone.

Pericardium and Pericardial Fluid

The heart is enclosed in a sac known as the Pericardium. There is a fluid, known as pericardial fluid between the Pericardium and the heart walls.

Function of Pericardial fluids:

It reduces friction between the pericardium and the heart, during heart contractions.

Chambers of Human Heart

The human heart consists of four chambers.

(i) Right and Left Atria

The upper thin walled chambers are called the left and right atria.

(ii) Right and Left Ventricles

The lower thick walled chambers are called the left and right ventricles. The left ventricle is the largest and strongest chamber in heart.

Working of Heart as a Double Pump

It works as a double pump. It receives deoxygenated (with less oxygen) blood from body and pumps it to lungs. At the same time, it receives oxygenated (with more oxygen) blood from lungs and pumps it to the whole body.

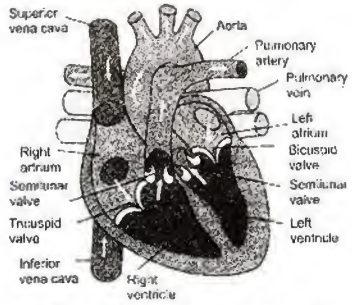


Figure 9.10: Human heart; structure and

Circulation of Blood (Double Pump Mechanism)

(i) Circulation of Deoxygenated Blood

Right atrium receives deoxygenated blood from the body via the main veins i.e. superior and inferior vena

cava. When right atrium contracts, it passes the deoxygenated blood to the right ventricle. When right ventricle contracts, the blood is passed to pulmonary trunk which carries blood to the lungs.

(ii) Tricuspid Valve

The opening between the right atrium and the right ventricle is guarded by a valve (because it has 3 flaps). It prevents the backflow of blood from right ventricle to the right atrium.

(iii) Pulmonary Semilunar Valve

Location:

At the base of the pulmonary trunk, pulmonary semilunar valve is present.

Function:

It prevents the backflow of blood from pulmonary trunk to right ventricle.

(iv) Circulation of Oxygenated Blood:

The oxygenated blood from the lungs is brought by pulmonary veins to left atrium. The left atrium contracts and pumps this blood to the left ventricle. When the left ventricle contracts, it pumps the oxygenated blood in aorta, which carries the blood to all parts of the body (except lungs).

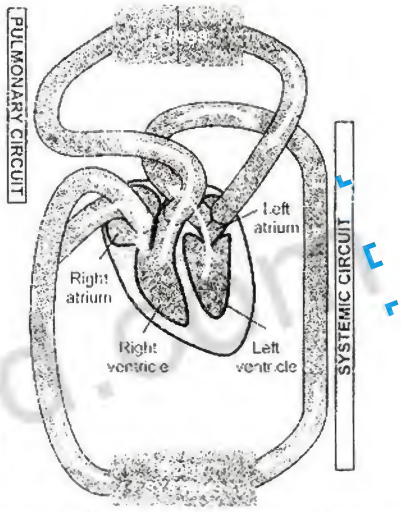


Figure 9.11 Double circuit circulation of blood

(v) Bicuspid Valve

The opening between the left atrium and the left ventricle is guarded by a valve known as bicuspid valve (because it has two flaps).

Function:

It prevents the back flow of blood from the left ventricle to the left atrium.

(vi) Aortic Semilunar Valve

Location:

At the base of aorta, the aortic semilunar valve is present.

Function:

It prevents the back flow of blood from aorta to the left ventricles.

Q. 15. Define pulmonary circulation and systemic circulation.

Pulmonary circulation or circuit

The pathway on which deoxygenated blood is carried from the heart to the lungs and in return oxygenated blood is carried from the lungs to the heart is called pulmonary circulation or circuit.

Systemic circulation or Circuit

The pathway on which oxygenated blood is carried from the heart to the body tissues and in return deoxygenated blood is carried from the body tissues to the heart is called systemic circulation or circuit.

Q. 16. Describe cardiac cycle and Heartbeat.

Cardiac cycle and Heartbeat

The alternating relaxations and contractions of chambers of heart make up the cardiac cycle and one complete cardiac cycle makes one heart beat.

Steps of Cardiac Cycle

(i) Cardiac diastole

The atria and ventricles relax and blood is filled in atria. This period is called cardiac diastole.

(ii) Atrial Systole

Immediately after the filling of atria, both atria contract and pump the blood towards ventricles. This period in cardiac cycle is called atrial systole.

(iii) Ventricular Systole

When both ventricles contract and pump the blood towards body and lungs, the period of ventricular contraction is called ventricular systole.

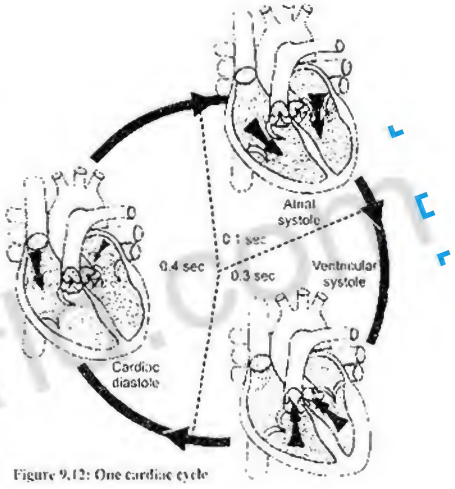


Figure 9.12: One cardiac cycle

In one heartbeat, diastole lasts about 0.4 seconds, atrial systole takes about 0.1 seconds, and the ventricular systoles lasts about 0.3 seconds.

"Lubb Dubb"

When ventricles contract, the tricuspid and bicuspid valves close and "lubb" sound is produced. Similarly when ventricles relax, the semilunar valves close and "dub" sound is produced. "Lubb dubb" can be heared with the help of a stethoscope.

Heart rate:

The heart rate is the number of times the heart beats per minute.

Normal Range of Heart rate

At rest or during normal activities, the heart beats 70 times per minute in men and 75 times per minute in women.

Measurement of Heart Rate

The heart rate can be measured by feeling the pulse.

Pulse

Pulse is the rhythmic expansion and contraction of an artery as blood is forced through it by the regular contractions of the heart.

Measurement Areas of Pulse:

The pulse can be felt at the areas where the artery is close to the skin for example at wrist, neck, groin or the top of the foot.

Most commonly, people measure their pulse in their wrist.

Figure 9.13: Method of taking pulse

Q.17. Write a note on different types of blood vessels.

Ans. Blood vessels

Third most important part of blood circulatory system are blood vessels. Their function is to transport blood throughout body.

Types of Blood Vessels

1. Arteries

Definition

Arteries are the blood vessels, that carry blood away from the heart. All arteries with the exception of the pulmonary artery, carry oxygenated blood.

Structure

The structure of the arteries is adapted to their function. The walls of an artery are composed of three layers.

Outer most layer

The outer most layer is made of connective tissue.

Middle layer

Middle layer is made up of smooth muscles and elastic tissue.

Inner most layer

The inner most layer is made up of endothelial cells. The hollow internal cavity in which the blood flow is called the lumen.

Arterioles

When arteries enter body organ, they divide into smaller vessels known as arterioles. The arterioles enter tissues and further divide into capillaries.

2-Capillaries:

Definition:

Capillaries are the smallest blood vessels which are formed by the divisions of arterioles.

Structure:

The walls of capillaries are composed of only a single layer of cells, the endothelium. This layer is so thin that molecules of digested food, oxygen and water etc. can pass through them and enter the tissue fluid.

Process occurring in Capillaries:

The exchange of materials between blood and tissue fluid is carried through capillaries.

Waste products

Waste product such as carbon dioxide and urea can diffuse from tissue fluid into the blood.

3. Veins

Definition:

A Vein is the blood vessel that carry blood toward the heart. In adult, all veins with the exception of pulmonary vein, carry deoxygenated blood.

Structure:

Veins are also well adapted to their function. The walls of veins are composed of same three layers as are present in the artery wall with the difference that the middle layer of vein has less smooth muscles and elastic tissue as compared to artery. The lumen of the veins is broader than that of arteries.

In a tissue, capillaries join to form small venules, which join to form veins. Most veins have flaps, called valves that prevent the back flow of blood.

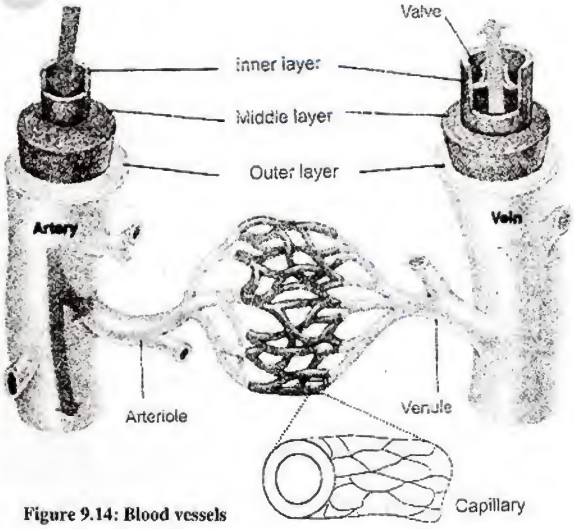


Figure 9.14: Blood vessels

Table 9.2: Comparison between arteries, veins and capillaries.

Characteristics	Arteries	Capillaries	Veins
Function	Carry blood away from heart	Allow the exchange of materials between blood and tissues	Carry blood towards heart
Thickness and Elasticity in walls	Thick and elastic	One-cell thick non-elastic walls	Thin and less elastic
Muscles in walls	Thick	No muscles	Thin
Blood pressure	High BP	Medium	Low BP
Valves	No valves	No valves	Valves present

Q.18. Explain general plan of human blood circulatory system. OR

Describe Human Arterial and Venous System in detail.

Ans. Many scientists worked on circulation of blood in human body. Following two important scientists gave the knowledge of the blood circulatory system:

(i) Ibn-e-Nafees (1210-1286): He was physician and the first scientist who described the pathway of blood circulation.

(ii) William Harvey (1578-1651): He discovered the pumping action of heart. He also described the pathway of blood in major arteries and veins.

The Arterial System

Pulmonary arteries

The large pulmonary trunk emerges from the right ventricle. It divides into right and left pulmonary arteries. These arteries carry the deoxygenated blood to the right and the left lungs.

Aorta and Dorsal Aorta

The oxygenated blood leaving the left ventricle of the heart is carried in a large artery i.e aorta. The aorta ascends and forms an aortic arch. The arch curves left and descends inferiorly into the body. Three arteries arises from the upper surface of the aortic

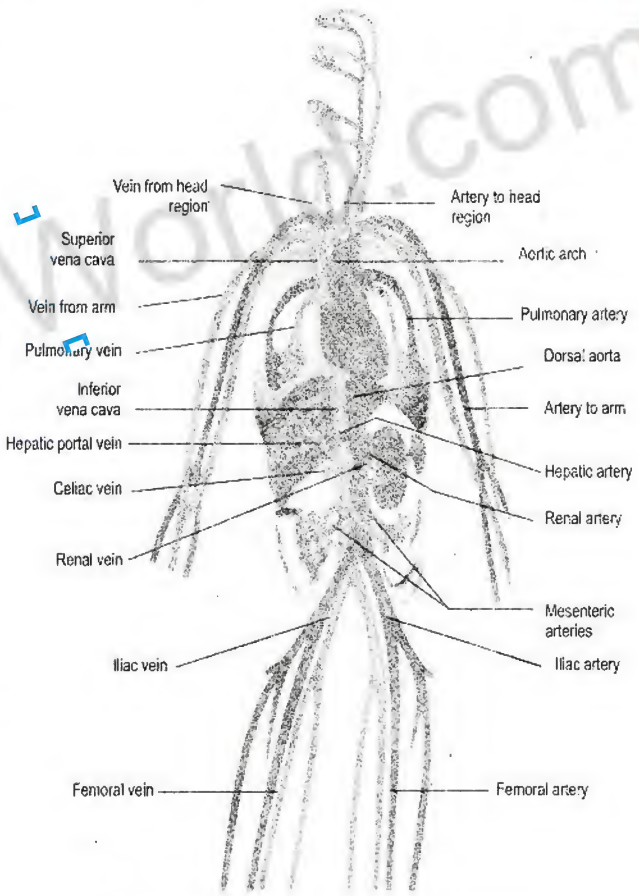


Figure 9.15: Major arteries and veins in human body

arch. These arteries supply blood to head, shoulders and arms. As aorta passes down through the thorax, it becomes the dorsal aorta. The dorsal aorta gives many branches. These are:-

(i) Intercostal arteries: Several intercostal arteries supply blood to the ribs.

(ii) Caeliac artery and superior mesenteric arteries: The caeliac artery and the superior mesenteric artery supplies blood to digestive tract.

(iii) Hepatic arteries: Hepatic artery supplies blood to the liver.

(iv) Renal arteries: A pair of renal arteries that supply blood to kidneys.

(v) Gonadal arteries: These arteries supply blood to the gonads.

(vi) Inferior mesenteric artery: It is present just below the gonadal arteries. It supplies blood to large intestine and rectum.

(vii) Common iliac Arteries: Then the aorta divides into two common iliac arteries, each of which divides into two arteries:

(i) Internal iliac artery: It supplies blood to legs.

(ii) External iliac artery: Each external iliac becomes the femoral artery in the upper thigh. It gives branches to thigh, knee, shank, ankle and foot.

Coronary circulation

Heart muscles also require blood. The blood supply to the heart muscles is provided by the coronary arteries. It arises from the base of the aorta. The coronary veins collect blood from the heart muscles. It empties into the right atrium. The coronary arteries and veins are collectively comprise coronary circulation. It is a part of the systemic circulation.

The Venous System

(i) Pulmonary veins: Veins from lungs called pulmonary veins return oxygenated blood to left atrium of the heart.

(ii) Two Major veins

Two major veins i.e. superior vena cava and inferior vena cava carry the deoxygenated blood from rest of the body and empty into right atrium.

(a) Superior vena cava: It is a major vein. Different veins from the head, shoulders and arms join together. They form superior vena cava. It opens into right atrium.

(b) Inferior vena cava: It is formed by many veins in the legs. It brings deoxygenated blood to the heart.

(i) Common iliac veins: Veins carrying blood from calf, foot and knee join together to form the femoral vein. Femoral veins opens into the external iliac vein which joins with the internal illiac to form common iliac vein. The right and left common iliac veins join to form the inferior vena cava.

(ii) Renal veins: The two renal veins carry blood from the kidneys.

(iii) Gonadal veins: Two gonadal veins carry blood from gonads to the inferior vena cava.

(iv) Hepatic portal system: Veins coming from the stomach, spleen, pancreas and intestine drain into the hepatic portal vein. It carries the blood to the liver. From liver, hepatic vein carries blood and empties into inferior vena cava.

(v) In the thoracic cavity, the inferior vena cava also receives veins from thoracic walls and ribs.

Q.19. Write a note on cardiovascular disorders.

Ans. Diseases that involve the heart or blood vessels are collectively called cardiovascular disorders.

Causes of cardiovascular Diseases:

i. Advanced age
ii. Diabetes
iii. High blood concentration of low density lipids, (e.g. cholesterol) and triglycerides,
iv. Tobacco smoking
v. High blood pressure (Hypertension)
vi. Obesity
vii. Sedentary life style

Atherosclerosis:

Definition:

Disease affecting arteries, commonly referred to as a narrowing of the arteries is called Atherosclerosis.

Causes:

It is a chronic disease in which there is accumulation of fatty material cholesterol or fibrin in arteries.

i. When this condition is severe, arteries can no longer expand and contract properly and blood moves through them with difficulty.
ii. Cholesterol is accumulated in the vessels which results in the formation of multiple deposits called plaques within arteries.
iii. Plaques can form blood clots called thrombus within arteries.
iv. If a thrombus dislodges and becomes free floating, it is called an embolus.

Arteriosclerosis:

Arteriosclerosis is a general term describing any hardening of arteries. It occurs when calcium is deposited in the walls of arteries, it can happen when atherosclerosis is severe.

Myocardial infarction

Definition:

It is commonly known as heart attack.

Causes:

i. It is a Medical condition that occurs when blood supply to a part of the heart is interrupted and leads to death of heart muscles.

ii. Blood clot in coronary arteries.

Tissue death

The term myocardial infarction is derived from myocardium (heart muscle) and infraction (tissue death)

Symptoms

(i) Severe chest pain is the most common symptom of heart attack.

(ii) It often describes as a sensation of tightness, pressure or squeezing.

(iii) Pain radiates, most often to left arm but may also radiate to lower jaw, neck, right arm and back.

(iv)Loss of consciousness and even sudden death can occur in myocardial infarction.

Treatment

(i) Immediate treatment for suspected acute myocardial infarction is oxygen supply

(ii) Aspirin and sublingual tablet of glycerol trinitrate.

(iii)In most cases, it is treated with angioplasty, (mechanical widening of a narrowed or totally obstructed blood vessel) or bypass surgery (surgery in which arteries or veins from elsewhere in the patient's body are grafted to the coronary arteries to improve the blood supply to heart muscles).

Angina Pectoris:

Angina Pectoris means "chest pain" occurs for reason similar of those which cause heart attack. But it is not as severe as heart attack. The pain may occur in heart and often in left arm and shoulder. It is a warning sign that the blood supply to the heart muscles is not sufficient but the shortage is not enough to cause tissue death.

Silent heart attack:

Approximately one fourth of all myocardial infarctions are silent, without any chest pain or other symptoms. A silent heart attack is more common in the elderly patients with diabetes mellitus and after heart transplantation.

World heart day:

World heart day held on 28th September every year throughout the world. Its objective is to help people better understand their personal risk of cardiovascular disorders.

Myocardial infarction in Pakistan:

i. Cardiovascular disorders are the cause of 12% of the adult death in Pakistan (source, federal Bureau of Statistics of Pakistan)

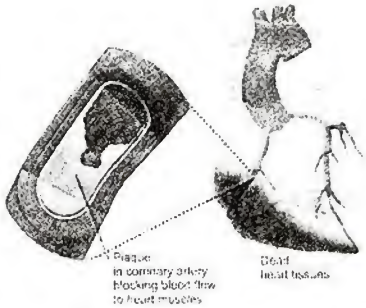


Fig: 9.16 Atherosclerosis and resulting Myocardial infarction

ii. Hypertension (high blood pressure) is most common cause of cardio vascular disorder in Pakistan.
iii. There are over 12 million hypertension patients in Pakistan.
iv. About 10% of our population is diabetic.
v. According to world health organization in Pakistan, one in 7 urban adults are obese.

Multiple Choice Questions

1. In most plants, the food is transported in the form of;
(a) Glucose (b) Sucrose
(c) Starch (d) Proteins

2. Stomata close when the guard cells;
(a) Lose water
(b) Gain chloride ions
(c) Become turgid
(d) Gain potassium ions

3. Trace the pathway of water from the soil through the plant to the atmosphere.
(a) Endodermis, cortex, epidermis, xylem, intercellular spaces in mesophyll, stomata
(b) Epidermis, endodermis, phloem, cortex of leaf, intercellular spaces of mesophyll, stomata
(c) Root hairs, epidermis, Cortex, xylem, endodermis, intercellular spaces in mesophyll, stomata
(d) Root hairs, cortex, endodermis, xylem, intercellular spaces in mesophyll, stomata

4. When fibrinogen makes blood clot, it separates from blood and the remainder is called;
(a) Plasma (b) Lymph
(c) Serum (d) Puss

5. What is correct about human red blood cells?
(a) Have limited life span
(b) Are capable of phagocytosis
(c) Produce antibodies
(d) Are multinucleate

6. Which of the following tissue layer is found in all blood vessels?
(a) Smooth muscle
(b) Endothelium
(c) Skeletal muscle
(d) Connective tissue

7. When do the atria contract?
(a) Before diastole
(b) after systole
(c) During diastole
(d) during systole

8. Which of following contains deoxygenated blood in an adult human?
(a) Left atrium.
(b) pulmonary artery
(c) Pulmonary vein
(d) All of the above

9. Which of the following chambers has the thickest walls in human heart?
(a) Right atrium (b) Left atrium

(c) Left ventricle (d) Right ventricle

10. Which of these statements is correct about the circulatory system?
(a) It transports hormones
(b) Capillaries have thicker walls than veins
(c) Systemic circulation carries blood to and from the lungs
(d) All are true

11. The exchange of materials between the blood and the surrounding tissues occurs in;
(a) Arteries (b) Veins
(c) Capillaries (d) All of the above

12. Which of the following is a type of leukocyte?
(a) Lymphocytes (b) Eosinophil
(c) Monocyte (d) All of the above

13. Which of the following is a function of human blood?
(a) It regulates body temperature
(b) It transports wastes
(c) It provides defense
(d) All of the above

14. Valves to prevent the backflow of blood are found in;
(a) Arteries (b) Veins
(c) Capillaries (d) All of the above

15. Plasma is made up of water and _____.
(a) Metabolites and wastes
(b) Salts and ions
(c) Proteins
(d) All of the above

16. Which of these are responsible for blood clotting?
(a) Platelets (b) Erythrocytes
(c) Neutrophils (d) Basophils

17. Find the correct path of blood circulation.
(a) Left atrium, left ventricle, lungs, right atrium, right ventricle, body
(b) Right atrium, right ventricle, lungs, left atrium, left ventricle, body
(c) Left atrium, left ventricle, right atrium, right ventricle, lungs, body
(d) Right atrium, lungs, right ventricle, left atrium, body, left ventricle

18. A patient with blood group A can be given the blood of donor who has;
(a) Blood group A or AB
(b) Blood group A or O
(c) Blood group A only
(d) Blood group O only

19. The death of the heart tissue is called;
(a) Arteriosclerosis
(b) Atherosclerosis
(c) Myocardial infarction
(d) Thalassaemia

20. What happens when a mismatched blood group is injected in recipient?
(a) Antibodies of the recipient's blood destroy donor's RBCs
(b) Antibodies of the donor's blood breakdown recipient's RBCs
(c) Both of these can happen
(d) None of these happens and such transfusion can be safe

21. Which of the followings in not true about the opening and Closing of Stomata?
(a) Light helps in the opening and closing of stomata

(b) K^+ ions are responsible for the opening and closing of stomata

(c) The osmosis of water is responsible for the opening and closing of stomata

(d) None of these

22. The rate of transpiration is increased when:

(a) Low light

(b) Temperature decrease

(c) Humidity increased

(d) none of these

23. Which of the followings is area of supply of food in plants?

(a) Leaf (b) Stem

(c) Fruit (d) All

24. There is separation of oxygenated and deoxygenated blood in birds and mammals because:

(a) The ventricles are completely divided

(b) The ventral aorta is divided into aortic and pulmonary trunk.

(c) The aortic arch is divided into two systemic arches.

(d) None of above

25. Which of the following blood vessels have oxygenated blood?

(a) Pulmonary artery

(b) pulmonary vein

(c) Superior vena cave

(d) inferior vena cave

26. The amount of plasma in blood is:

(a) 35% (b) 45%

(c) 55% (d) 65%

27. The percentage of inorganic salts and ions in the plasma is.:

(a) 0.6 (b) 0.7

(c) 0.8 (d) 0.9

28. The normal pH of the human blood is:

(a) 6.4 (b) 7.4

(c) 8.4 (d) 9.4

29. The percentage of the plasma protein in the blood is:

(a) 4 – 5 (b) 5 – 6

(c) 7 – 8 (d) 7 – 9

30. Which of the following proteins is not present in the plasma of the blood?

(a) Immunoglobulin or antibodies

(b) Prothrombin

(c) Haemoglobin

(c) Fibrinogen

31. Which of the following cells is most abundant in the blood?

(a) Red blood cells

(b) White blood cells

(c) Platelets

(d) None of the above

32. A cubic millimeter blood of male contains RBC:

(a) 5 – 5 .5 million

(b) 4 – 4.5 million

(c) 3 – 4 million

(d) none of the above

33. Which of the followings are not Granulocytes?

(a) Neutrophils (b) eosinophils

(c) Monocytes (d) basophils

34. Pus is formed from which of the following dead white blood cells?

(a) Lymphocytes (b) eosinophils

(c) Monocytes (d) basophils

35. Which of the following structure are not cells.
(a) Lymphocytes (b) eosinophils
(c) Monocytes (d) platelets

36. Which of the following process is a homeostasis?
(a) To maintain the amount of water constant in the blood
(b) To maintain the functioning of the body
(c) To maintain the process of respiration
(d) To maintain the muscular activity

37. Which of the following is not the function of blood?
(a) It transport gases in the body
(b) It transports reproductive cells in the body
(c) It transport food within the body
(d) It transport waste material in body

38. Which of the followings is Leukaemia?
(a) Uncontrolled production of RBC
(b) Uncontrolled production of WBC
(c) Uncontrolled production of Platelets
(d) All of the above

39. Thalassaemia is an abnormality of:
(a) RBC (b) WBC
(c) Platelets (d) None of these

40. The valve present between right atrium and right ventricle is called:
(a) Tricuspid valve
(b) Bicuspid valve
(c) Semilunar valve
(d) none of the above

41. The valve present between left atrium and left ventricle is called:
(a) Tricuspid valve
(b) Bicuspid valve
(c) Semilunar valve
(d) none of the above

42. The valve present at the base of aorta is called:
(a) Tricuspid valve
(b) Bicuspid valve
(c) Semilunar valve
(d) none of the above

43. Which of the following arteries supply blood to legs?
(a) Femoral artery
(b) Renal artery
(c) Coronary artery
(d) pulmonary artery

44. Which of the following veins does collect blood from the digestive system and supply blood to liver?
(a) Hepatic vein
(b) Hepatic portal vein
(c) Renal veins
(d) none of the above

45. The voice of lubb is produced during the contraction of heart when:
(a) Tricuspid valve is closed
(b) Bicuspid valve is closed
(c) Both tricuspid and bicuspid valves are closed
(d) Semilunar valves are closed

46. The voice of dub is produced during the contraction of heart when:
(a) Tricuspid valve is closed
(b) Bicuspid valve is closed

(c) Both tricuspid and bicuspid are closed
(d) Semilunar valves are closed

47. Which of these layers is present in the arteries?
(a) Connective tissues and elastic fibres
(b) Smooth and circular muscles
(c) Connective tissues
(d) All of the above

48. Which of the followings is Atherosclerosis?
(a) The breaking of the wall of the artery
(b) The narrowness of the wall of the artery
(c) The deposition of fats in the wall of the artery
(d) None of the above

49. Which of the followings is the characteristic of capillary?
(a) It has three layers of endothelium
(b) It has one layer of endothelium
(c) It has one layer of connective tissues
(d) It has one layer of elastic tissues

50. Which of followings is the main function of capillaries?
(a) Supply blood to tissues
(b) Exchange of materials
(c) Bring blood from tissues
(d) Transport of materials

51. Which of the following layers is thin in veins?
(a) Connective tissues and elastic fibres
(b) Smooth and elastic tissues.
(c) Connective tissues
(d) All of the above

52. Which of following veins has oxygenated blood?
(a) Renal vein
(b) Hepatic vein
(c) Pulmonary vein
(d) Coronary vein

53. In which of the following blood vessels has high blood pressure?
(a) Artery (b) Vein
(c) Capillary (d) non of the above

54. In which of the following blood vessels, pulse is felt?
(a) Artery (b) Vein
(c) Capillary (d) non of the above

55. Which of the followings are blood vessels responsible for exchange of material?
(a) Artery (b) Vein
(c) Capillary (d) none of the above

56. Which of followings is the cause of hypertension?
(a) Low blood pressure
(b) High blood pressure
(c) Cholesterol level
(d) All of the above

57. Which of the followings is thrombus?
(a) A blockage of blood vessel
(b) A clot in the vessel
(c) A moving clot in vessel
(d) None of the above

58. Which of the following is embolus?
(a) A blockage of blood vessel
(b) A clot in the vessel
(c) A moving clot in vessel
(d) None of the above

59. Which of the following condition is helpful in the prevention of heart attack?
(a) Avoid too much fatty food rich in cholesterol.
(b) Maintain normal body weight
(c) Control the blood pressure by regular walk and exercises.
(d) All of the above

60. Tricuspid valve contains no. of flaps:
(a) Four (b) Five
(c) Three (d) Two
(Lahore board 2011 G II)

Answers

1.	b	12.	d	23.	d	34.	a	45.	c	56.	b
2.	a	13.	d	24.	a	35.	d	46.	d	57.	b
3.	d	14.	b	25.	b	36.	a	47.	d	58.	c
4.	c	15.	d	26.	c	37.	b	48.	b	59.	d
5.	a	16.	a	27.	d	38.	b	49.	b	60.	c
6.	b	17.	b	28.	b	39.	a	50.	b		
7.	d	18.	b	29.	d	40.	a	51.	b		
8.	b	19.	c	30.	c	41.	b	52.	c		
9.	c	20.	c	31.	a	42.	c	53.	a		
10.	a	21.	d	32.	a	43.	a	54.	a		
11.	c	22.	d	33.	c	44.	b	55.	c		

Short Questions

Q.1. What is ABO blood group system? Who did discover it?

Ans. It is the most important blood group system in humans, it was discovered by the Austrian scientist Karl Landsteiner in 1900. He found four different blood groups (blood types). He was awarded the Nobel Prize in Medicine for his work. There are four different blood groups in this system. These groups are distinct from each other on the basis of specific antigens (antigen A and B). These antigens are present on the surface of RBC's. After birth, two types of antibodies i.e. anti-A and anti-B antibodies appear in the blood of individuals. These antibodies are present according to the absence of corresponding antigen.

Q.2. What is agglutination?

Ans. Clumping of blood cells during blood transfusion is called agglutination. If agglutination occurs, the clumped cells cannot pass through capillaries.

Q.3. What are agranulocytes?

Ans. These are types of white blood cells. They have clear cytoplasm and include monocytes (produce macrophages which engulf germs) and B and T lymphocytes (produce antibodies and kill germs).

Q.4. What is albumin?

Ans. It is an important protein present in blood which maintains the water balance of blood.

Q.5. What is Angina Pectoris? **(Lahore board 2011 G II)**

Ans. Angina Pectoris means "Chest Pain". It is not as severe as heart attack. The pain may occur in heart and often in left arm and shoulder. It is a warning sign that blood supply to heart muscles is not sufficient but shortage is not enough to cause death.

Q.6. What are Anti-A antibodies and Anti-B antibodies?

Ans. Antibodies are proteinacious substances produced by lymphocytes. It is a type of white blood cells. These are produced in response to antigens and then pass to plasma and lymph. They are a part of body's immune system.

After birth, two types of antibodies i.e., anti-A and anti-B antibodies appear in the blood serum of individuals. These antibodies are present according to the absence of corresponding antigen.

In persons with blood group A, antigen A is present and their blood contains anti-B antibodies.

In persons with blood group B, antigen B is present. So their blood will contain anti-A antibody.

Q.7. What are antigens? Write about antigen A & B?

Ans. An antigen is a proteinacious molecule that can stimulate an immune response. There are two types of antigens.

Antigen A: A person having antigen A has blood group A.

Antigen B: A person having antigen B has blood group B.

A person having both antigens has blood group AB and person having none of the A and B has blood group O.

Q.8. What is anti-Rh antibody?

Ans. If an Rh-negative person receives Rh-positive blood, he/she will produce anti-Rh antibodies against Rh factors.

Q.9. What are aorta and aortic arch?

Ans. The oxygenated blood leaves the left ventricle of the heart. This blood is pumped into aorta, aorta is largest artery. The aorta ascends and it forms an aortic arch. The arch curves left and descends inferiorly into the body.

Q.10. Define artery. Which blood does it carry?

Ans. The blood vessels carry blood away from the heart are called arteries. All arteries except pulmonary arteries carry oxygenated blood. Their structures are well adapted for their function.

Q.11. What are atherosclerosis and arteriosclerosis?

Ans. The narrowing of the arteries is called atherosclerosis. Hardening of arteries is called arteriosclerosis.

Q.12. Define atrial systole.

Ans. When both atria contract and pump blood towards ventricles, this period in cardiac cycle is called atrial systole.

Q.13. What is an atrium?

Ans. The upper thin-walled chambers of heart are called left and right atria (singular atrium).

Q.14. Define Basophils.

Ans. One of the WBCs is granulocytes. Basophils is a granulocytes which help in preventing blood from clotting.

Q.15. What are tricuspid and bicuspid valves?

Ans. There is opening between the right atrium and the right ventricle. It is guarded by a valve called tricuspid valve. It has three flaps. An opening is also present between the left atrium and the left ventricle. It is guarded by a valve called bicuspid valve. The walls of left ventricle are the thickest. These are about a half – inch thick. They have enough force to push blood into the body.

Q.16. Define blood group systems. **(Lahore board 2011 G I)**

Ans. Blood group system is the classification of blood on the basis of presence or absence of antigens on the surface of red blood cells. An antigen is a molecule that can stimulate an immune response for antibody production. These antigens may be proteins or polysaccharides. Their nature depends on the blood group system.

Q.17. Define capillary. Give its functions?

Ans. The blood vessels composed of single layer of cells which are used for exchange of materials are called capillaries. Capillaries are the smallest blood vessels. These are formed by the divisions of arterioles. The exchange of materials between blood and tissue fluid is carried out through the capillaries.

Q.18. Define cardiac cycle and heart beat?

Ans. The alternating relaxations and contractions make up the cardiac cycle. One complete cardiac cycle makes one heartbeat. Heart relaxes and its chambers fill with blood. It contracts and its chambers propels the blood out of them.

Q.19. What is cardiovascular system?

Ans. Human blood circulatory system is also called cardiovascular system. Like other vertebrates, humans have a closed circulatory system (meaning that blood never leaves the network of arteries, veins and capillaries).

The main components of the human blood circulatory system are blood, heart and blood vessels.

Q.20. Define cohesion tension theory. **(Lahore board 2012 G I)**

Ans. According to this theory, the mechanism by which water (along with dissolved materials) is carried upward through the xylem is called transpirational pull. Transpiration creates a pressure difference. It pulls water and salts up from the roots.

Q.21. What is coronary circulation?

Ans. From the base of aorta, coronary arteries originates and supply blood to heart muscles. Coronary vein collect blood from heart muscles. This circulation is called coronary circulation.

Q.22. What is Cortex?

Ans. External to endodermis in the root and stem, there is a broad zone of cortex. It consists of large and thin - walled cells.

Q.23. Define Diastole.

Ans. When atria and ventricles of heart relax and blood is filled in atria. This period is called cardiac diastole.

Q.24. What is Dorsal aorta?

Ans. As aorta passes down through thorax, it becomes dorsal aorta. It gives off many branches which supply oxygenated blood to different body parts.

Q.25. Define Endodermis and Pericycle.

Ans. In the root and stem, outside the conducting tissues, there is a narrow layer of thin walled cells, the pericycle. A single layer of cells i.e. endodermis surrounds this pericycle.

Q.26. What are thrombus and embolus?

Ans. Thrombus:

Multiple deposits in arteries called plaque. Plaques can form blood clots called thrombus.

Embolus:

If a thrombus dislodges and becomes free floating, it is Called embolus.

Q.27. What is the structure of red blood cells (RBCs) or Erythrocytes?

Ans. These are most numerous blood cells. These cells have nucleus when formed. In the RBCs of mammals, the nucleus, mitochondria, endoplasmic reticulum etc., are lost. These are lost when they mature before they enter blood. About 95% of the cytoplasm of red blood cells is filled with haemoglobin. It transports O_2, and small amounts of CO_2. The remaining 5% consists of enzymes, salts and other proteins. These cells once mature, do not divide.

Q.28. What is Fibrin?

Ans. Fibrin or cholesterol is fatty material when accumulated in the arteries caused narrowing of arteries or artherosclerosis.

Q.29. Which proteins do present in plasma? What is their role?

Ans. Proteins constitute 7-9 % by weight of the plasma. The proteins which are present in plasma:

(i) **Antibodies:** Antibodies are produced by lymphocytes. It is a type of white blood cells. These are produced in response to antigens and then passed to plasma and lymph. They are a part of body's immune system.

(ii) **Fibrinogen:** Fibrinogen is a plasma protein. It takes part in the blood clotting process.

Q.30. What are granulocytes?

Ans. Granulocyte is a type of WBCs and have glanular cytoplasm. These include:

(v) Neutrophils (destroy small particles by phagocytosis)

(vi) Eosinophils: (break inflammatory substances and kill parasites)

(vii) Basophils, prevent blood clotting

Q.31. What are guard cells? **(Lahore board 2012 G I)**

Ans. Guard cells are bean shaped cells in the lower epidermis of the leaf which control the opening and closing of stomata.

Q.32. What is Haemoglobin?

Ans. About 95% of the cytoplasm of RBCs is filled with a protein called haemoglobin which transports O_2 and small amounts of CO_2. It is red in colour and red colour of blood is due to haemoglobin.

Q.33. What are heart rate and pulse rate?

Ans. The number of times the heart beats per minute is called **heart rate.** At rest, heart rate is 60 – 90 times, 70 is average. The heart rate can be measured by feeling the pulse. Pulse is the rhythmic expansion and contraction of an artery as blood is forced through it by the regular contractions of the heart. The pulse can be felt at the areas where the arteries are close to the skin. Its examples are wrist, neck, groin or top of the foot.

Q.34. What are lenticels?

Ans. Lenticels are special openings in the stems of some plants. It helps in transpiration.

Q.35. Define Leucocytes or white blood cells?

Ans. These are colourless. They are granular or agranular, contain large nucleus larger in size than RBCs. Their average number is 7500/mm^3 Of blood. They play role in body's defence by engulfing small particles, release anticoagulants or produce antibodies.

Q.36. What is leukaemia (blood cancer)? **(Lahore board 2011 G I)**

Ans. The uncontrolled production of cells is called cancer. In leukaemia, a great number of immature and abnormal white blood cells appear in the bone marrow. They are also often produced in the spleen and liver. This is caused by a cancerous mutation in bone marrow cells. It results in production of uncontrolled white blood cells. The mutated bone marrow cells spread to other parts of the body. So white blood cells start producing in many other organs. These white blood cells are not completely differentiated. Therefore, they are defective.

Q.37. What are lymphocytes?

Ans. Lymphocytes are agranulocytes. Two types are B and T lymphocytes which produce antibodies and kill germs.

Q.38. Define Megakaryocytes.

Ans. Platelets are not cells, but are fragments of large cells of bone marrow called megakaryocytes. They do not have any nucleus and any pigment and help in blood clotting.

Q.39. Define Monocytes.

Ans. Monocytes are agranulocytes which produce macrophages which engulf germs.

Q.40. Define neutrophils.

Ans. Neutrophils are granulocytes which destroy small particles by phagocytosis.

Q.41. What is myocardial infarction?

Ans. The term myocardial infarction is derived from myocardium (the heart muscle) and infarction (tissue death). It is more commonly known as a heart attack. It occurs because of

(1) Interruption in the blood supply to the heart muscles.

(2) Blood clot in coronary arteries.

Q.42. What is pericardium?

Ans. The heart is enclosed in a sac called pericardium. A pericardial fluid is present between the pericardium and the heart walls. It reduces friction between the pericardium and heart during contractions.

Q.43. What are Xylem and Phloem?

Ans. Xylem: Xylem tissue is responsible for the transport of water and dissolved substances from roots to aerial parts. It consists of vessel elements and tracheids.

Phloem: Phloem tissue is responsible for the conduction of dissolved organic matter (food) between different parts of plant body. It consists of sieve tube cells and companion cells.

Q.44. What do you know about platelets or thrombocytes?

Ans. They are not cells but are fragments of large cells of bone marrow. Platelets help in conversion of fibrinogen into fibrin. Fibrinogen is a soluble plasma protein. The fibrin threads entangle with the red blood cells and other platelets in the area of damaged tissue. They ultimately form a blood clot.

Q.45. What is plasma?

Ans. Plasma is primarily water in which proteins, salts, ions, metabolites and wastes are dissolved. Water constitutes about 90-92% of plasma. 8-10% of plasma are dissolved substances.

Q.46. What are pulmonary arteries?

Ans. The large pulmonary trunk emerges from the right ventricle. It divides into right and left pulmonary arteries. These arteries carry the deoxygenated blood to the right and the left lungs.

Q.47. What is pulmonary pathway or circuit?

Ans. This pathway carries deoxygenated blood from the heart to the lungs. It brings oxygenated blood from lungs to the left atrium of heart. It has lower pressure than systemic circulation. It gives sufficient time for gaseous exchange to occur in the lungs:

Q.48. Define Pulmonary Veins.

Ans. Veins from lungs bring the oxygenated blood to the left atrium of heart are called pulmonary veins.

Q.49. What is Pulse?

Ans. Pulse is the rhythmic expansion and contraction of an artery as blood is forced through it by the regular contractions of heart.

Q.50. What is Rh Blood group system? Who did discover it?

Ans. Karl Landsteiner in 1930's discovered the Rh-blood group system. In this system, there are two blood groups i.e. Rh^{+} and Rh^{-}. They are distinct from each other on the basis of antigens called Rh factor. Rh factor was first discovered in Rhesus monkey. It is present on the surface of RBCs. A person having Rh factor has blood group Rh-positive while a person not having Rh factor has blood group Rh-negative.

Q.51. What is the importance of root hairs?

Ans. Root hairs provide large surface area for absorption. They grow out into the spaces between soil particles where they are in direct contact with the water. The cytoplasm of the root hairs has higher concentration of salt than the soil water. Therefore, water moves by osmosis into the root hairs. Salts also enter root hairs by diffusion or active transport.

Q.52. What are semilunar valve?

Ans. There are two types of semilunar valves:

(a) Pulmonary Semilunar Valve

At the base of pulmonary trunk, pulmonary semilunar valve is present which prevents the back flow of blood from pulmonary trunk to right ventricle.

(b) Aortic Semilunar Valve

At the base of aorta, aortic semilunar valve is present which prevents the back flow of blood from aorta to left ventricle.

Q.53. What is stoma? **(Lahore board 2011 G I)**

Ans. Stomata (singular: stoma) are minute openings in the lower epidermis of leaves guarded by guard cells. Stomata helps in exchange of gases.

Q.54. What is systematic circulation?

Ans. The pathway on which oxygenated blood is carried from heart to body tissues and in return deoxygenated blood is carried from body tissues to heart is called systemic circulation.

Q.55. Define transpiration. How does it take place? **(Lahore board 2012 G II)**

Ans. The loss of water from surface of plant through evaporation is called transpiration. This loss may occur through stomata in leaves. It may occur through the cuticle present on leaf-epidermis. It also occurs through special openings called lenticels. Lenticels are present in the stems of some plants.

Q.56. What is Thalassaemia? Who did discover it?

Ans. It was discovered by Thomas B. Cooley. Therefore, it is also called Cooley's anaemia. It is a genetic problem. It is caused due to mutations in the gene of haemoglobin.

Q.57. What is transpirational pull?

Ans. The pulling force created by the transpiration of water is called transpirational pull. It also causes water to move transversely (from root epidermis to cortex and pericycle).

Q.58. Define veins. What blood do they carry?

Ans. A blood vessel that carries blood toward the heart is called vein. All veins except pulmonary veins, carry deoxygenated blood. Veins are also well-adapted to their function. The walls of vein, are composed of the same three layers like artery wall.

Q.59. What are superior and inferior vena cava?

Ans. Superior vena cava: Different veins from the head, shoulders and arms join together to form superior vena cava.

Inferior vena cava: Different veins from posterior part of body join to form inferior vena cava.

Q.60. Define ventricles.

Ans. The lower thick walled chambers of the human heart are called left and right ventricles. Left ventricle is the largest and strongest chamber in heart.

Q.61. What is atrial and ventricular systole?

Ans. When both atria contract and pump the blood towards ventricles, this period in cardiac cycle is called atrial systole. Atrial systole takes 0.1 seconds. Now both ventricles contract. They pump the blood towards body and lungs. The period of ventricular contraction is called ventricular systole. Ventricular systole lasts about 0.3 seconds.

Q.62. Define venule.

Ans. In tissues, capillaries join to form small venules, which join to form veins.

Q.63. What do you know about wilting?

Ans. Transpiration maybe a harmful process in the sense that during the conditions of drought, loss of water from plant results in serious desiccation, wilting and often death.

Q.64. What is importance of water for plants?

Ans. Water is vital to plant life. It is necessary for photosynthesis and turgor. Much of the cellular activities occur in the presence of water. Water also regulates internal temperature of the plant.

Q.65. What are the functions of Root?

Ans. Roots perform vital functions

1. Roots anchor the plant in the soil..
2. They absorb water and salts from the soil.
3. They provide conducting tissues. These tissues distribute these substances to the tissues of the stem.

Q.66. How do stomata open and close?

Ans. The guard cells of stomata absorb water and become turgid, their margins Curve apart. The stoma between them opens. When guard cells lose water, they become flaccid and stomata are closed.

Q.67. What is the role of K^+ in opening of stomata?

Ans. The blue wave lengths of day light allows K+ to flow into guard cells from the surrounding epidermal cells. Water passively follows these ions into guard cells. It increases their turgidity and open stoma.

Q.68. How temperature effects transpiration?

Ans. High temperature increases the kinetic energy of water molecules. In this way it increases the rate of transpiration. The rate of transpiration doubles with every rise of 10°C in temperature. But very high temperature 40-45°C causes closure of stomata

Q.69. What is the effect of humidity on transpiration?

Ans. Water vapours diffuse quickly in dry air. Water evaporates from the surface of mesophyll cells into leaf air spaces. They then move from air spaces to outside. This increases the rate of transpiration. In humid air, the rate of the diffusion of water vapours is

reduced. As the air is already saturated with water vapours, thus the rate of transpiration is low.

Q.70. What is the harmful effects of transpiration?

Ans. Transpiration requires wet surfaces from which evaporation can occur. But water is lost from the plant during the drought conditions. It results in wilting, serious desiccation. It often causes death of the plant in such conditions. This is the reason plant closes stomata at high temperatures. It reduces transpiration rate to prevent wilting.

Q.71. Differentiate source from sink.

Ans. The source is exporting orgâns It may be a mature leaf or storage organ. Sinks are the areas of active metabolism or storage. For example, roots, tubers, developing fruits and leaves, and the growing regions.

Q.72. Define blood. **(Lahore board 2011 G I)**

Ans. Blood is a specialized form of connective tissue that is composed of a liquid called blood plasma and blood cells suspended within the plasma. The weight of blood in our body is about $\frac{1}{12\text{th}}$ of our body. The average adult has a blood volume of 5 litres.

Q.73. Which salts do present in plasma?

Ans. The salts make up 0.9% of the plasma by weight. More than two third of this amount is sodium chloride (the table salt). Salts of bicarbonate are also present in considerable amounts. Ca, Mg, Cu, K and Zn are found in trace amounts.

Q.74. Which nitrogenous wastes do present in plasma?

Ans. Plasma also contains nitrogenous waste products. These wastes are formed as a result of cellular metabolism. These are urea and salts of uric acid.

Q.75. Where are RBC formed and destroyed?

Ans. They are formed in liver and spleen in the embryonic and foetal life. In adults, they are formed in the red bone marrow of short and flat bone. The average life span of a red blood cell is four months (120 days). After this, they break down in liver and spleen by phagocytosis.

Q.76. Write three functions of blood.

Ans. Blood is the major agent for the transport of materials in the body, transports nutrients, water, salts and waste products. It also transports hormones from the endocrine tissues to the target sites. Blood transports respiratory gases O_2 and CO_2. Blood helps in body's defense against diseases.

Q.77. What is role of blood in homeostasis?

Ans. Blood maintains body temperature and concentration of water and salts. Blood is also responsible for maintaining the amounts of chemicals in the body constant or nearly constant levels. It thus helps in homeostasis.

Q.78. What is the treatment of Thalassaemia?

Ans. The blood of these patients is replaced regularly with normal blood. It can also be cured by bone marrow transplant. But it is very expensive and does not give 100% cure rate. The world celebrates the international Thalassaemia Day on 8th of May.

Q.79. What are blood group AB and O?

Ans. A person having both antigens A and B has blood group AB. Both antigens are present in it. So their blood serum will contain no antibody. A person having none of the A and B antigens has blood group O. So their blood serum will contain both anti A and anti B antibodies.

Q.80. What is the process of cross matching?

Ans. During blood transfusion process, in order to avoid agglutination, blood sample of donor and recipient's blood are cross matched for compatibility. Antibodies of the recipient's blood may destroy the corresponding antigen containing RBCs of the donor. Similarly, the antibodies of the donor's blood may destroy the antigen containing RBCs of the recipient.

Q.81. What are universal donors and universal recipients?

Ans. Individuals with blood group O are called **universal donors**. They can donate blood to the recipients of every other blood group. Individuals with blood group AB are called **universal recipients**. They can receive transfusions from the donors of every other blood group.

Q.82. What is human heart?

Ans. The heart is a muscular organ. It contracts repeatedly. It is responsible for pumping blood through the blood vessels. Cardiac means related to the heart. The bulk of the walls of the heart chambers is made of cardiac branched striated cells. Each cell has single nucleus. These are capable of strong contraction and relaxation making the heart " a pumping organ."

Q.83. How heart works as double pump?

Ans. Human heart works as a double pump. It receives deoxygenated (with less oxygen) blood from body. It then pumps it to the lungs. At the same time, it receives oxygenated (with more oxygen) blood from lungs. It pumps it to all the body. The deoxygenated and oxygenated bloods are separated inside heart chambers.

Q.84. How is sound produced during heartbeat?

Ans. The ventricles contract the tricuspid and bicuspid valves close. It produces sound of lubb. Now ventricles relax and the semilunar valves close. It produces sound dubb. Lubb – dubb can be heard with the help of a stethoscope.

Q.85. What layers are present in the artery?

Ans. The outermost layer of artery is composed of connective tissue. The middle layer is made up of smooth muscles and elastic tissue. The innermost layer is made up of mainly endothelial cells. The hollow internal cavity in which the blood flows is called the lumen.

Q.86. Which scientists did play role in the discovery of blood circulation in blood vessels?

Ans. Two important scientists gave the knowledge of the blood circulatory system. These were:

(i) Ibn-e-Nafees (1210-1286): He was a physician. He was the first scientists who described the pathway of blood circulation.

(ii) William Harvey (1578-1651): He discovered the pumping action of heart. He also described the pathway of blood in major arteries and veins.

Q.87. What is hepatic portal system?

Ans. Many veins come from stomach, spleen, pancreas and intestine opens into hepatic portal vein. It carries the blood to the liver. Hepatic vein carry blood from liver. It opens into inferior vena cava.